# UNITED STATES PATENT AND TRADEMARK OFFICE

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 09/496,068 | 02/01/2000 | Anil M. Murching | PU020211 | 5671 |

7590     01/16/2004

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|---|
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| ART UNIT | PAPER NUMBER |
|---|---|
| 2623 | |

DATE MAILED: 01/16/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on <u>28 August 2003</u>.

2a)☐ This action is **FINAL.**      2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1 and 3-8* is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,3-5,7 and 8* is/are rejected.

7)☒ Claim(s) *6* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. §§ 119 and 120**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a)☐ All b)☐ Some * c)☐ None of:

      1.☐ Certified copies of the priority documents have been received.

      2.☐ Certified copies of the priority documents have been received in Application No. _____.

      3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

13)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

    a) ☐ The translation of the foreign language provisional application has been received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .

4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: .

## DETAILED ACTION

### *Continued Examination Under 37 CFR 1.114*

1.      A request for continued examination under 37 CFR 1.114, including the fee set forth in

37 CFR 1.17(e), was filed in this application after final rejection.  Since this application is

eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e)

has been timely paid, the finality of the previous Office action has been withdrawn pursuant to

37 CFR 1.114.  Applicant's submission filed on 28 August 2003 has been entered.

### *Response to Arguments*

2.      Applicant's arguments with respect to claims 1, 7, and 8 have been considered but are

moot in view of the new ground(s) of rejection.

### *Claim Rejections - 35 USC § 103*

3.      The text of those sections of Title 35, U.S. Code not included in this action can be found

in a prior Office action.

4.      Claims 1 and 3-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over

Shafarenko in view of "Unsupervised Video Segmentation Based on Watersheds and Temporal

Tracking" by Wang and U.S. Patent 5,577,131 by Oddou.

Regarding claim 1, Shafarenko discloses a method of extracting regions of homogeneous

color in a digital picture comprising:

dividing the digital picture into blocks (Shafarenko operates on pixels, which are the

smallest image blocks); and

merging together spatially adjacent blocks that have similar color properties to extract the regions of homogeneous color (Abstract: watershed routine is used to merge pixels according to color contrast).

Shafarenko discloses the merging step comprises:

extracting a feature vector for each block (Shafarenko processes pixels in LUV color space; the L, U, and V values for each pixel comprise a feature vector);

estimate a scalar gradient value for each block as a function of the feature vector, the set of gradient values defining a color gradient field (Section B, paragraph 2, page 1533: each pixel is assigned an LUV gradient value according to the maximum Euclidean distance to the furthest neighbor; the set of all gradient values produces a field);

segmenting the gradient field with a watershed algorithm that divides the gradient field into a set of spatially connected regions of homogeneous color (third paragraph, page 1531: watershed algorithm uses LUV gradient to segment image by color).

Shafarenko is silent to digitizing the color gradient field. However, Shafarenko's method is implemented on a computer, so any computed values are digital.

Shafarenko is silent to preprocessing the digitized color gradient field to produce a smoothed color gradient field.

Wang discloses a similar segmentation routine, wherein image gradients are applied to a watershed algorithm to segment an image into homogeneous regions. Wang teaches smoothing the gradient field prior to utilizing it for the watershed algorithm. Wang dilates then erodes the gradient image, thereby reducing local minima caused by noise or quantization error (Section A, step 3, page 540).

It would have been obvious to one of ordinary skill in the art at the time of the invention

to modify Shafarenko by Wang in order to preprocess the color gradient field as claimed, since

Wang teaches smoothing the gradient field removes noise.

Shafarenko and Wang are silent to dividing the digital picture into blocks, <u>wherein each</u>

<u>block comprises a plurality of pixels</u>, and performing the claimed steps on the blocks, rather than

individual pixels.

Oddou discloses a system for segmenting images into homogeneous regions by applying

a watershed algorithm to a gradient field in much the same manner as Shafarenko and Wang. In

particular, Oddou discloses performing the segmentation routine on blocks of pixels rather than

individual pixels. Column 8, lines 39-54: an image to be segmented is divided into macroblocks

that are e.g. 16x16 in size; then parameters are extracted from each block based on the average

value of pixels in each block, and the segmentation routine is performed on the basis of the

parameters of each block. Thus, by averaging each 16x16 block of pixels and utilizing the

average values for the segmentation, Oddou essentially reduces the resolution of the image by a

factor of 16 and treats the 16x16 blocks as individual pixels.

Although Oddou seeks to segment by texture rather than by color, the major advantage of

operating on blocks of pixels rather than individual pixels to segment an image is apparent to

those skilled in the art – processing time is reduced.

It would have been obvious to one of ordinary skill in the art at the time of the invention

to modify Shafarenko and Wang by Oddou to perform the steps for extracting regions of

homogeneous color on blocks of pixels rather than individual pixels since operating on blocks of

pixels rather than individual pixels is less computationally intensive.

Regarding claim 3, Shafarenko discloses the extracting step comprises:

transforming the data in each block into a perceptually uniform color system (Section B, page 1533: pixels are placed in perceptually uniform LUV color space);

calculate N moments of the data in each block for each color component, the set of moments being the feature vector for the block (the moment is simply the L, U, and V average values of the block, per Oddou's averaging of the blocks).

Regarding claim 4, Shafarenko discloses the estimating step comprises:

selecting the maximum of the distances between the feature vector of each block and the neighboring vectors as the gradient value for the block (Section B, paragraph 2, page 1533: each pixel (i.e. block) is mapped onto the distance to its furthest neighbor).

Shafarenko does not expressly disclose obtaining distances between the feature vector of each block and the feature vectors of each neighboring block. However, in order to find the maximum distance, all of the distances must be known. Therefore, this step of obtaining is implicit in Shafarenko's teaching.

Regarding claim 5, Shafarenko teaches applying a weighted Euclidean distance metric to the feature vectors to determine the distances (Section B, paragraph 2, page 1533: Euclidean distance is used to estimate the gradient; weighting is unity since there is only one moment for each block).

5.      Claims 7 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over "Incorporation of Derivative Priors in Adaptive Bayesian Color Image Segmentation" by Luo et

al. ("Luo") in view of "Pyramidal Retrieval by Color Perceptive Regions" by Corridoni et al.

("Corridoni").

Regarding claim 7, Luo discloses a method for representing regions of homogeneous

color in a digital picture (section 2.2, page 781: "As a result, an image will be segmented into

regions of *uniform, or more often, slowly varying* colors") producing data comprising the steps

of:

dividing the digital picture into blocks (i.e. each pixel constitutes a block);

estimating a scalar gradient value for each block by defining a color gradient field

corresponding to each block (Section 2.5: first-order derivatives are estimated from edge

detection, which utilizes the vector gradient of the image. Luo uses the methods of Lee and

Cok's "Detecting Boundaries in a Vector Field" for performing the edge detection. In section III

of Lee et al., a vector gradient (i.e. gradient field) is estimated for each point (pixel), wherein the

vector gradient comprising the scalar magnitude of the gradient (see page 1182, paragraph

beginning: "If one travels...");

representing said data corresponding to the digital picture as a probability distribution of

blocks of the digital picture that are spatial[ly] connected and homogeneous in color for a search

application (Luo represents the image data as a maximum *a posteriori* (MAP) probability using a

Gibbs distribution in order to achieve a segmented image. A MAP estimation (equation (1)),

which is modeled as a Gibbs distribution (equation (3)), defines the regions of spatially

connected pixels that are homogeneous in color (i.e. the MAP estimate is used to segment the

image by color). See figure 1).

Luo is silent to the data being suitable for use in an image database application.

Corridoni discloses a region-based image querying system, whereby images are segmented into regions of homogeneous color at different levels of resolution, and those regions are used for matching queries and retrieving images in an image database application. In particular, Corridoni discloses segmenting an image into regions of coherent color (section 2), describing the features of each of the regions (section 2.1), and allowing a user to form queries for searching for database images based on the region descriptors (section 3). Thus, Corridoni teaches the color segmentation of an image provides data that is suitable for use in an image database search application.

Therefore, Luo's data, which represents the homogeneous color regions of an image, are suitable for use in an image database application, since Corridoni teaches that a color segmentation of an image produces data that is suitable for searching for the image in a database application.

Regarding claim 8, Luo discloses a method for representing spatial relationships between regions of homogeneous color in a digital picture (e.g. figure 1: spatial relationship between homogeneous regions) producing data comprising the steps of:

dividing the digital picture into blocks (i.e. each pixel constitutes a block);

estimating a scalar gradient value for each block by defining a color gradient field corresponding to each block (see corresponding explanation for claim 7);

representing said data corresponding to the digital picture as a probability distribution function calculated in view of blocks of the digital picture that are homogeneous in color and distances between the blocks that are homogeneous in color (Luo represents the image data as a

maximum *a posteriori* (MAP) probability function using a Gibbs distribution in order to achieve

a segmented image, as explained above for claim 7. Luo discloses that the MAP function is

calculated in view of blocks of the digital picture (i.e. it is calculated based on the pixels of the

digital picture). Luo also discloses that the MAP function is calculated in view of distances

between the blocks (i.e. it is based on the first-order derivatives, which are derived from the

gradient magnitudes, or distances between blocks (see section 2.5). It should be noted that pixels

are homogeneous in color – they exhibit the same color throughout the area of the pixel.

Therefore, every block of Luo is homogeneous in color).

Luo is silent to the data being suitable for use in an image database application.

Corridoni discloses a region-based image querying system, whereby images are

segmented into regions of homogeneous color at different levels of resolution, and those regions

are used for matching queries and retrieving images in an image database application. In

particular, Corridoni discloses segmenting an image into regions of coherent color (section 2),

describing the features of each of the regions (section 2.1), and allowing a user to form queries

for searching for database images based on the region descriptors (section 3). Thus, Corridoni

teaches the color segmentation of an image provides data that is suitable for use in an image

database application.

Therefore, Luo's data, which represents the homogeneous color regions of an image, are

suitable for use in an image database application, since Corridoni teaches that a color

segmentation of an image produces data that is suitable for searching for the image in a database

application.

*Allowable Subject Matter*

6.      Claim 6 is objected to as being dependent upon a rejected base claim, but would be

allowable if rewritten in independent form including all of the limitations of the base claim and

any intervening claims.


*Conclusion*

Any inquiry concerning this communication or earlier communications from the

examiner should be directed to Colin M. LaRose whose telephone number is (703) 306-3489.

The examiner can normally be reached Monday through Thursday from 8:00 to 5:30. The

examiner can also be reached on alternate Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Amelia Au, can be reached on (703) 308-6604. The fax phone number for the

organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding

should be directed to the TC 2600 Customer Service Office whose telephone number is (703)

306-0377.

AMELIA M. AU
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600

CML
Group Art Unit 2623
12 January 2003